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HAVE WE A JUST STANDARD OF INDUSTRIAL INTELLIGENCE?

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There has recently been brought to my notice a copy of *Readings in Industrial Society* by Marshall. On the wrapper of this book is stated: "This book furnishes a foundation for a thorough understanding and intelligent handling of industrial questions." It appears that very much of the philosophy of the numerous writers whose works have been drawn upon for this material is the outgrowth of an estimate of industrial intelligence which this writer believes to be quite erroneous. If the supposition on which those authorities have worked is not correct, the whole discussion is of little value, because, as is evident, the first essential of progress toward a solution of industrial problems, including all public education as well as industrial education, is to establish a correct valuation of the intellectual requirements of industry.

This requirement is not only essential as a basis for correct educational theory, but is of even greater value in placing a proper relation between industrial workers and all other persons in society· Fundamentally this latter is the chief, because to determine the intellectual factor is to determine the position of the individual in society, and this necessarially determines his probable needs in all respects, including those which raise the question of hours of labor, how much for work and how much for study or pleasure, and therefore what training or education is needed not only to fit for work but also for all other purposes. Briefly, until we have a very definite and correct measure of the intellectual requirements of industry we have no foundation on which we may build a social or industrial philosophy.

Why we should drift into the belief that the introduction of machinery has lowered the average requirements of intelligence in industry seems unexplainable. Adam Smith, even before machine tools had begun to develop and when such machines as were used in manufacturing were of the most simple types, wrote: "Each individual becomes more expert in his own branch, more work is done upon the whole, and the quantity of science is considerably increased by it." If this were true at the very dawn of machine development how much more true it must be today after a century and a half of work of master-minds in the development of mechanical science. The acme of this development is well exemplified in the modern screw machine, gear planer, and turret lathe, and yet we see many indications that eminent social philosophers class the master-minds operating these machines as of a low order of intelligence.

This incorrect estimate of the intelligence required in the operation of modern tools and machinery is possibly the one basic cause of all modern industrial unrest: first, in that it fails to recognize a development of intelligence that feels a greater number of social needs—has raised the worker to a higher level of social intelligence than those in control are willing to grant; and, second, in that because of this larger intelligence in the work than is granted, labor does not receive its just share of the rewards of the joint enterprise of worker and machine. We no doubt would be surprised at the results of a calculation as to what would now be the just share of the operator in the machine and its adjuncts if we credit to the operator only 2 or 3 per cent more of the income of the joint enterprise than he has received since the advent of the machine. We may grant this as an accumulation of an interest in the machine or as a share in the capital.

Viewing the problem in this light, to show that the intelligence necessary to machine operation is such as to make the operator's share 2 or 3 per cent greater than has been granted by the capitalist, is to render obsolete substantially all our present social and industrial philosophy and to establish a cause for little less than an industrial revolution, if the laborer is to be granted his back pay that would from such an estimate rightfully belong to him.

As an element in the social philosophy of the present it determines whether our theories are tending to ameliorate conditions by obtaining justice or to increase the difficulty by finding excuses for even further exploitation of the workingman. It gives an entirely different interpretation to the question as to whether the laboring class is in its present straitened circumstances because of extravagance and wastefulness for which they themselves are responsible, or because of exploitation by those controlling the situation. It will then appear that the real cause is that an erroneous standard of living has been set up by the capitalistic class because of having a surplus of funds that does not belong to them, and thus not only hindering the proper accumulation of wealth in the hands of the common people or working classes by robbing them of their rightful compensation, but actually greatly increasing the strain because of establishing a standard of expense and living that no one has by right the funds to maintain.

Briefly, if industrial harmony is to be brought about by justice to all parties, then the first fundamental to be determined is the relative values of intelligence put into industrial tasks by each workman and class of workmen, and then establish standards of income and of living in harmony with the conditions of each and the standards of intelligence and resulting needs of the various members of society.

Who could have coined such a senseless phrase as "All men are equal before the machine" is beyond our comprehension. Further, we are told that the law of machinery is a law of statical order, and we read various other statements pointing to the conclusion that those writers believe that as the machine becomes more nearly automatic the need for intelligence on the part of the operator is lessened. It seems to this writer that a visit to almost any plant would convince one of ordinary powers of observation that such statements and conclusions are entirely unwarranted. The very appearance of the workmen ought to be sufficient to cause a serious doubt about such a low grade of mentality as the statements of those writers appear to presume.

Perhaps we may get a correct point of view easiest by use of illustrations. A little girl was being greatly troubled by the older members of the family who constantly questioned her as to what she would do when grown up. One Sunday afternoon she went to her mother in a serious frame of mind and said, "Mamma, now I know what I am going to do when I get big and have to work. I am going to be a minister, for all you have to do is just to stand in the pulpit and talk." A teacher of psychology once said that he thought there ought to be some way to overcome the terrible mental atrophy that must result from running those screw machines in a plant that he had visited. A certain plant was equipped for making bicycles. Special care was taken to have the best screw machines obtainable. They were guaranteed both as to quantity and quality of production. After they were in operation for a time the manufacturer was notified that they would neither produce the amount of work specified nor would they work with sufficient accuracy. The manufacturer sent a man to see about the trouble. He found the operator overworking trying to keep the machines going and failing entirely. The new man soon had both quantity and quality up to the guaranty and was able to sit in a chair about half the time. If our psychologist had visited this plant first when the man who failed was in charge, and again while the man who succeeded was on the job, which one would he have concluded was the most in need of something to keep his mind from atrophying?

It is related of Horace Greely that he went to a lecture appointment a day early and listened to the minister at the Sunday services. The minister's son noticed an old man who seemed to have no interest in the sermon and soon appeared to be asleep. The young man was greatly surprised when his father took the stranger home to dinner and more surprised when he listened to Mr. Greely as he discussed the sermon.

In a large plant where there was a semi-automatic machine the pieces had to be put in one at a time and the machine did the work. Usually, only cheap help was employed at this machine, as the foreman prided himself on getting work out at a minimum of expense. The regular hand quit and it was necessary to put another man in his place. The new operator looked the machine over, fixed it up, and decided to run it on a faster speed. To do this he must watch it very closely, for he had learned that gold eagles are not the only pieces of metal that are not of the same density throughout. This necessitated his keeping his ear close to the cutter. Being a tall person, this could be accomplished without undue fatigue only by sitting down. He got a nail keg and sat close to his machine, but as his ear was directed toward the cutter his eyes were apparently looking about the room. Only a day or so elapsed before the foreman called him down for his lazy tendencies in sitting at his work. This, of course, resulted in his putting the machine back on slow speed and assuming a more attentive attitude. When foremen of long experience will make such blunders what may we expect of those who have never operated a machine of any kind?

The same students of industry who will class the screw-machine operator as one doing work requiring only a low grade of intelligence, would not apply the same methods of determination to the lawyer who sits with eyes closed and feet upon the railing. Neither would they apply the same method to the engineer of the big power plant, who is usually seen in an easy chair "doing nothing," or perhaps smoking, or reading a paper. Why? Because in these other lines there are some elements that afford points of contact, while in the highly scientific working of solid materials the social scientist is so far removed as to be only a child watching a minister talk.

It is easy for the professor of social science to speak of the low grade of intelligence required to run a drill after the jig is in place. The best proof of the simplicity is for the professor to try it and show how easy it is. The writer remembers an incident that happened in a room where he was working. The foreman who had charge of the room for many years left the plant. It was a large room and a great variety of work was carried on in the different divisions. For this reason a foreman was taken from another part of the factory, a foreman who was considered exceptionally competent and of great mechanical ability and training. This particular job was drawing a rather high rate of pay and the new foreman concluded to cut the rate. Some of the hands objected, and a discussion followed in which the foreman made the remark that the operation was so simple that anyone could do it and that the only factor was that of practice to get up the required speed. The usual speed was about two pieces a minute. One of the men suggested that if it was so simple the foreman should try it and prove his statement. The foreman was foolish enough to make the attempt, but after about two hours of attempts and spoiling of material he gave up, with a great deal more respect for his workmen. Yet the writer can say from actual knowledge that the success of this operation depends upon a use of intelligence and knowledge rather than skill, and that the apparently simple operation actually requires a whole book of knowledge which has to be used within the limits of thirty seconds.

From the writer's years of experience about drill presses, and also in teaching in a variety of schools, including normal schools and a university in which he has come in contact with teachers of all grades, he will venture that he can select persons who have held positions as successful teachers who have not a sufficiently high grade of mentality to run successfully the average drill press using a jig of average difficulty, and that he can find some people who have the legal qualification to teach, and actually do get positions year after year, who could not hold a position at any drill press that is required to produce a standard commercial product, and for the simple reason that they have too low a grade of intelligence for such work.

Another way of approach to this problem of determining the intelligence of machine operatives, that may be more easily understood, is to consider the factor of safety necessitated by the nature of such work. It is not thought improper to send a child to the store with a half-dollar to make a small purchase. The possible loss is at most but a small amount, and we may therefore tax the intelligence of the child to the limit with a possibility of overtaxing it. If the transaction is larger we not only consider it essential that it be intrusted to one able to perform it under usual conditions, but we consider it a matter of prudence to employ a person who would be able to carry out our wishes even under some exceptional difficulty—we would plan to be well within safe limits. Should we present a check for a few cents at a bank window it will be cashed by one who is thoroughly competent to cash checks of any amount, because the bank officials feel that there should be a factor of safety permitting of no possible error.

In the use of hand tools the workman may be so incompetent as to do poor work with an occasional piece spoiled. The amount done is small and the possible loss not large. His factor of safety may be little or nothing with his level of intelligence barely sufficient to accomplish the work. Add to his productive power but a simple machine, and at once the risks are larger and the factor of safety is necessarily increased. With the fully automatic machine the possibilities of spoiling work become so great that the factor of safety must be many times increased; and also the possibility of damage to a machine necessitates a knowledge of the machine many times greater than is likely to be required in any regular work. That this factor of safety is considered in all manufacturing enterprises is well understood by employers. That it is the real measure of the machine operative's intelligence rather than the limited knowledge necessary to pull a lever or place a piece of material in a machine is beyond question.

There appear to have been a great many attempts to define a machine. So far no one seems to be satisfied. May we suggest yet another definition. No doubt we all will consent to the statement that there was a time when there were no tools, and that after the invention of tools a more or less extended period of time elapsed before the invention of a machine. Our problem is, therefore, to determine what differentiates the machine from the tool. This cannot consist in the application of muscle or human energy, for these are essential to the tool, neither can it be the use of intelligence, for this also is essential to the tool. Carrying our analysis yet farther we find that in some cases the intelligence is a constant factor of the movement, directing it to a greater or less degree at all times, as in the use of the hand plane, and that in other cases the intelligence predetermines what is to be done, as in the machine planer or surfacer. In hand planing the attention is constant for the purpose of continuous redirection. In machine planing the attention is for the purpose of seeing that the predetermined movement is properly completed. With the hand plane, to stop the attention is to stop the work. With the machine plane, the work might be completed even if the operator were to remove entirely from the machine.

This illustration is so obvious that more seem unnecessary, although they might be multiplied indefinitely. We, therefore, have as our definition, *A machine is a mechanism which performs a predetermined act.* With this definition we can readily place many machines and many tools in their respective classes, yet as is usual with attempts at classifications there will be some on the border line. The hand plow is clearly a tool and the gang plow with sulky is as clearly a machine. The scythe is a tool as is also the cradle and hand rake. Mowers, binders, and drills are machines.

With this definition the thesis becomes incontrovertible that the machine requires a higher type of intelligence than the tool, and the more nearly automatic the machine the greater the intellectual requirement in operating it. We can see no place for any exceptions to this rule, because to predetermine what is to be done requires the knowledge necessary to perform the act with simple tools, and in addition to this the operator must know all that is added by the machine, both as to the proper operation and also as to possible difficulties or errors. In addition to this he must be able to correlate all these factors in such a masterly manner as to insure substantial accuracy in results. These factors reach in our fully automatic machines a degree of intellectual requirement that is utterly beyond the understanding of those who have had no experience in such work.

In general we may assume that as the skill of the hand workman decreases by transfer to the machine, the requirement for scientific knowledge and a higher type of intelligence increases. As the machine relieves the workman of muscular exertion, the demand for intellectual exertion increases. As the machine becomes more perfectly automatic in its action, the controlling intelligence must become more intense and more highly developed, to the end that all factors may be given proper consideration and decisions reached with unerring exactness and promptness.

May we not, from these illustrations, draw the inference that the more intelligence exhibited in these industrial tasks the more simple they appear to those who do not understand the nature of their requirements? Further, in the higher grades of industrial activities, this intelligence reaches a development so far removed from that of other lines of mental effort as to have few if any points of contact with the usual academic lines, and to be consequently unrecognizable by our social scientists.

May we not still further infer that a final analysis of this problem of industrial intelligence may show that it extends downward to the most simple industrial occupations, differing in degree rather than in kind, and that our present discussions of social science, as well as our schemes of education, are dealing only with that comparatively insignificant factor of industrial activities which can be understood because of having some similar elements and points of contact with the usual academic lines, and that because of this misunderstanding little progress is made?

May it not be necessary for us to recognize that the whole field of industry requires a type of mind differing essentially from that of other lines, and as yet almost entirely unrecognized; and that the needs, ambitions, and just rewards due this type require methods of study and measurement in harmony with this type of intelligence?

The screw-machine operative cannot get by on a 75 per cent standard, neither can he prove his efficiency by quoting, or misquoting, authorities. His whole mental attitude must be in harmony with his work, and simply because it differs from that of the more usually considered lines does not necessarily represent any less acquisition or effort or training than others. To this writer it seems no more just to condemn the industrial worker to a lower plane of intelligence because he does not measure up with the standards set for other lines than to condemn other lines to a subordinate place because they cannot measure up if tested by the standards of the industrial worker.

Briefly, man's inhumanity to man is very largely the result of the inability of man to recognize the intelligence and worthwhileness of his fellow-man's labors.